

CLAIMS

What is claimed is:

1 1. A head suspension for supporting a head assembly in cooperative engagement
2 with a rotating disc in a disc drive, the head suspension mounted to an actuator for
3 controllably moving the head assembly radially over the surface of the disc, the head
4 suspension comprising:
5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;
7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;
9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying attitude of
11 the head assembly; and
12 means for controllably altering the flying attitude of the head assembly in
13 accordance with radial position of the head assembly in relation to the
14 disc.

1 2. A head suspension for supporting a head assembly in cooperative engagement
2 with a rotating disc in a disc drive, the head suspension mounted to an actuator for
3 controllably moving the head assembly radially over the surface of the disc, the head
4 suspension comprising:
5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;
7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;
9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying height of
11 the head assembly; and
12 means for controllably altering the flying height of the head assembly in
13 accordance with radial position of the head assembly in relation to the
14 disc.

1 3. A disc drive comprising:
2 a rotating disc mounted for rotation in the disc drive;
3 a head assembly for recording digital information to and retrieving information
4 from the disc;
5 a head suspension for mounting the head assembly and for providing static control
6 of a flying attitude of the head assembly above the rotating disc;
7 an actuator to which the head suspension is mounted for moving the head
8 assembly radially over the disc; and
9 means for dynamically controlling the flying attitude of the head assembly above
10 the disc in accordance with radial position of the head assembly in relation
11 to the disc.

1 4. A disc drive comprising:
2 a rotating disc mounted for rotation in the disc drive;
3 a head assembly for recording digital information to and retrieving information
4 from the disc;
5 a head suspension for mounting the head assembly and for providing static control
6 of a flying height of the head assembly above the rotating disc;
7 an actuator to which the head suspension is mounted for moving the head
8 assembly radially over the disc; and
9 means for dynamically controlling the flying height of the head assembly above
10 the disc in accordance with radial position of the head assembly in relation
11 to the disc.

1 5. A head suspension for supporting a head assembly in cooperative engagement
2 with a rotating disc in a disc drive, the disc comprising a landing zone proximate its inner
3 diameter and a data recording zone, the head suspension mounted to an actuator for
4 controllably moving the head assembly into and out of engagement with the data
5 recording zone and the landing zone, the head suspension comprising:
6 a gimbal portion for mounting the head assembly and providing compliance in
7 roll and pitch axes of the head assembly;

8 a load beam portion for exerting a load force on the head assembly to encourage
9 the head assembly toward the disc;
10 the gimbal portion and load beam portion being fixed in relation to each
11 other and configured to provide static control of a flying height of
12 the head assembly; and
13 means for dynamically increasing the flying height of the head assembly as the
14 head assembly is moved from engagement with the data recording area to
15 engagement with the textured landing zone.

1 6. A disc drive comprising:

2 a rotating disc mounted for rotation in the disc drive, the disc comprising a data
3 recording area and a textured landing zone near its inner diameter;
4 a head assembly for recording digital information to and retrieving information
5 from the disc;
6 a head suspension for mounting the head assembly and for providing static control
7 of a flying height of the head assembly above the rotating disc;
8 an actuator to which the head suspension is mounted for moving the head
9 assembly radially over the disc, and for moving the head assembly into
10 and out of radial alignment with the textured landing zone; and
11 means for dynamically increasing the flying height of the head assembly as the
12 head assembly is moved from engagement with the data recording area to
13 engagement with the textured landing zone.

1 7. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the head suspension mounted to an actuator for controllably
3 moving the head assembly radially over the surface of the disc, the head suspension
4 comprising:

5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;
7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;

9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying attitude of
11 the head assembly;
12 the gimbal portion further including bending elements for dynamically
13 controlling the flying attitude of the head assembly in accordance
14 with radial position of the head assembly with relation to the disc.

1 8. A head suspension as claimed in Claim 7, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and
4 the bending elements are mounted on the gimbal beams.

1 9. A head suspension as claimed in Claim 7, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams and a connecting cross member between distal
4 ends of the gimbal beams; and
5 the bending elements are mounted on the connecting cross member.

1 10. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the head suspension mounted to an actuator for controllably
3 moving the head assembly radially over the surface of the disc, the head suspension
4 comprising:
5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;
7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;
9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying height of
11 the head assembly;

12 the gimbal portion further including bending elements for dynamically controlling
13 the flying height of the head assembly in accordance with radial position
14 of the head assembly with relation to the disc.

1 11. A head suspension as claimed in Claim 10, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and
4 the bending elements are mounted on the gimbal beams.

1 12. A head suspension as claimed in Claim 10, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams and a connecting cross member between distal
4 ends of the gimbal beams; and
5 the bending elements are mounted on the connecting cross member.

1 13. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the disc comprising a textured landing zone proximate its
3 inner diameter and a data recording area, the head suspension mounted to an actuator for
4 controllably moving the head assembly radially over the surface of the disc and into and
5 out of engagement with data recording area and landing zone, the head suspension
6 comprising:

7 a gimbal portion for mounting the head assembly and providing compliance in
8 roll and pitch axes of the head assembly;
9 a load beam portion for exerting a load force on the head assembly to encourage
10 the head assembly toward the disc;
11 the gimbal portion and load beam portion being fixed in relation to each
12 other and configured to provide static control of a flying height of
13 the head assembly;
14 the gimbal portion further including bending elements for dynamically increasing
15 the flying height of the head assembly as the head assembly is moved

16 from engagement with the data recording area into engagement with the
17 landing zone.

1 14. A head suspension as claimed in Claim 13, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and
4 the bending elements are mounted on the gimbal beams.

1 15. A head suspension as claimed in Claim 13, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams and a connecting cross member between distal
4 ends of the gimbal beams; and
5 the bending elements are mounted on the connecting cross member.

1 16. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the head suspension mounted to an actuator for controllably
3 moving the head assembly radially over the surface of the disc, the head suspension
4 comprising:
5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;
7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;
9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying attitude of
11 the head assembly;
12 the gimbal portion further including bi-metal bending elements for
13 dynamically controlling the flying attitude of the head assembly in
14 accordance with radial position of the head assembly with relation
15 to the disc.

1 17. A head suspension as claimed in Claim 16, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and
4 the bending elements are mounted on the gimbal beams.

1 18. A head suspension as claimed in Claim 16, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams and a connecting cross member between distal
4 ends of the gimbal beams; and
5 the bending elements are mounted on the connecting cross member.

1 19. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the head suspension mounted to an actuator for controllably
3 moving the head assembly radially over the surface of the disc, the head suspension
4 comprising:
5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;
7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;
9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying height of
11 the head assembly;
12 the gimbal portion further including bi-metal bending elements for dynamically
13 controlling the flying height of the head assembly in accordance with
14 radial position of the head assembly with relation to the disc.

1 20. A head suspension as claimed in Claim 19, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and
4 the bending elements are mounted on the gimbal beams.

1 21. A head suspension as claimed in Claim 19, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams and a connecting cross member between distal
4 ends of the gimbal beams; and
5 the bending elements are mounted on the connecting cross member.

1 22. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the disc comprising a textured landing zone proximate its
3 inner diameter and a data recording area, the head suspension mounted to an actuator for
4 controllably moving the head assembly radially over the surface of the disc and into and
5 out of engagement with data recording area and landing zone, the head suspension
6 comprising:
7 a gimbal portion for mounting the head assembly and providing compliance in
8 roll and pitch axes of the head assembly;
9 a load beam portion for exerting a load force on the head assembly to encourage
10 the head assembly toward the disc;
11 the gimbal portion and load beam portion being fixed in relation to each
12 other and configured to provide static control of a flying height of
13 the head assembly;
14 the gimbal portion further including bi-metal bending elements for dynamically
15 increasing the flying height of the head assembly as the head assembly is
16 moved from engagement with the data recording area into engagement
17 with the landing zone.

1 23. A head suspension as claimed in Claim 22, wherein:
2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and
4 the bending elements are mounted on the gimbal beams.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100

2
3
4

5

- 1
- 2
- 3
- 4

5
6

7
8

9

10

11

12
13
14
15

1

2
3

4

1

2
3
4

5 the bending elements are mounted on the connecting cross member.

1 28. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the head suspension mounted to an actuator for controllably
3 moving the head assembly radially over the surface of the disc, the head suspension
4 comprising:

5 a gimbal portion for mounting the head assembly and providing compliance in
6 roll and pitch axes of the head assembly;

7 a load beam portion for exerting a load force on the head assembly to encourage
8 the head assembly toward the disc;

9 the gimbal portion and load beam portion being fixed in relation to each
10 other and configured to provide static control of a flying height of
11 the head assembly;

12 the gimbal portion further including piezo-electric bending elements for
13 dynamically controlling the flying height of the head assembly in
14 accordance with radial position of the head assembly with relation to the
15 disc.

1 29. A head suspension as claimed in Claim 28, wherein:

2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams; and

4 the bending elements are mounted on the gimbal beams.

1 30. A head suspension as claimed in Claim 28, wherein:

2 the gimbal portion further comprises a pair of laterally disposed, longitudinally
3 extending gimbal beams and a connecting cross member between distal
4 ends of the gimbal beams; and

5 the bending elements are mounted on the connecting cross member.

1 31. A head suspension for mounting a head assembly in cooperative engagement with
2 a rotating disc in a disc drive, the disc comprising a textured landing zone proximate its

inner diameter and data recording area, the head suspension mounted to an actuator for controllably moving the head assembly radially over the surface of the disc and into and out of engagement with data recording area and landing zone, the head suspension comprising:

a gimbal portion for mounting the head assembly and providing compliance in roll and pitch axes of the head assembly;

a load beam portion for exerting a load force on the head assembly to encourage the head assembly toward the disc;

the gimbal portion and load beam portion being fixed in relation to each other and configured to provide static control of a flying height of the head assembly;

the gimbal portion further including piezo-electric bending elements for dynamically increasing the flying height of the head assembly as the head assembly is moved from engagement with the data recording area into engagement with the landing zone.

32. A head suspension as claimed in Claim 31, wherein:

the gimbal portion further comprises a pair of laterally disposed, longitudinally extending gimbal beams; and

the bending elements are mounted on the gimbal beams.

33. A head suspension as claimed in Claim 31, wherein:

the gimbal portion further comprises a pair of laterally disposed, longitudinally extending gimbal beams and a connecting cross member between distal

ends of the gimbal beams; and

the bending elements are mounted on the connecting cross member.

SEA 9168
Patent Application
June 9, 2000